**FIELD SOIL SAMPLING**

**Materials**

Buckets

Soil auger

Latex gloves

Coolers for storing samples in the field, keep in cool areas as much as possible e.g. under a tree, and send samples to the lab within 24 hours of sampling.

**Procedure**

1. Familiarize yourself with the plot dimensions and do not sample areas that are unusual such as tree stump areas, termite mounds, and plot boundaries
2. Mark five soil sampling points on ridges, following a zig-zag path (see Figure 1) through the plot for every treatment

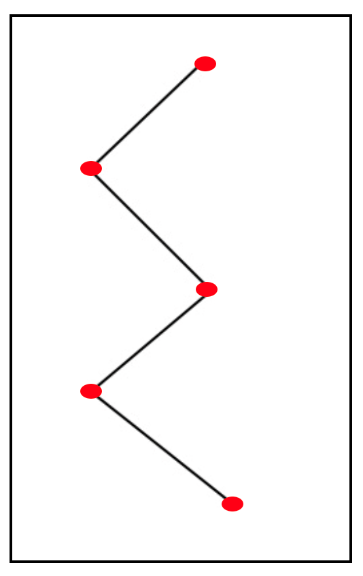


Figure 1. Plot soil sampling points following a zig-zag pattern

1. Label two buckets for each soil layer (0-20 and 20-40 cm)
2. At each sampling point, brush aside residues such as leaves and plant materials
3. Mark the sampling depths on the auger (0-20 cm and 20-40 cm)
4. Insert the auger directly into the soil in a vertical position and carefully remove the auger to avoid any spillage of the sample. Carefully take out soil samples from one soil depth at a time
5. Put the soil samples from each depth (0-20 cm and 20-40 cm) in the respective labelled bucket for each soil depth
6. Repeat the process for the other four sampling points on the plot
7. Put all five 0-20 cm depth soil samples from the five sampling points in one bucket and do the same for the 20-40 cm depth. Therefore, each bucket will have a composite sample from the same depth but from five sampling points
8. Thoroughly mix the soil and break soil clods in each bucket using hands (whilst wearing gloves), and remove any stones and vegetation in the sample
9. Pour about 500g of the composite sample into a pre-labelled plastic bag that has the sample ID and other appropriate information (e.g sample ID, date, location, farmer name, treatment, soil depth). Double-bag the plastic bag with the sample. Tie the bag.
10. Put the tied bag into another plastic bag and insert another label in between the two plastic bags
11. Put samples in a cooler and transport to lab that day or early the next day, for KCl extraction. Samples should be stored in a refrigerator (not the freezer!) until KCl extraction.
12. The extraction procedure can be done in any lab that has a refrigerator, and a balance to weigh samples, so at Bunda LUANAR, Chancellor, or at a technical college. The KCl extract should be made up beforehand so that at any laboratory this extraction below can be carried out.

**LABORATORY PROCEDURE: KCL EXTRACTION**

**Materials**

Gloves

Funnels

Balance

KCl

Plastic spoons

Distilled water

Weighing boats

50 ml centrifuge tubes

Envelopes or aluminium tins

20 ml plastic scintillation vials

Filter paper (Whatman #42 or #1)

**For all samples follow this procedure (even if the sample is dry it is still necessary to see how dry it is, as soils may seem dry yet have some moisture, so the oven-drying of the sample needs to be done in all cases).**

**Wear gloves for all steps.**

1. Prepare 2 Molar KCl (Weigh out 149.1 g of KCl and dilute to 1 litre with distilled water)
2. For each composite sample, prepare two labels with all the appropriate information about the sample (e.g sample ID, location, sampling date, farmer name, treatment, soil depth).
3. Weigh out two 10 g soil samples from each soil sample
4. Put one of the 10 g weighed sample into a centrifuge tube (for KCl extraction). Record the exact soil sample weight, with the sample identification, in a spreadsheet.
5. From the same sample, put the second 10 g weighed sample into a pre-weighed envelope or aluminum tin (for gravimetric soil moisture content determination). Record the soil sample and envelope/aluminium tin weights
6. ***Steps 7-13 are for the KCl extraction only. This is for the samples which were weighed into the 50 ml centrifuge tubes only.***
7. Add 40 ml of 2M KCl to the centrifuge tubes with soil. Also run 2 empty cups with just 100 ml of KCl as blanks
8. Cap centrifuge tubes and shake for one hour on high (180 rpm)

* While cups are shaking:
* Place plastic funnels in rack
* Fold filter paper (Whatman #42 or # 1) and place in funnels
* Place rinse cups under funnels
* Rinse the filter paper with 2 M KCl
* After rinsing, place labelled plastic scintillation vials under funnels (include soil sample ID, date of soil collection, location, farmer name, treatment, rep, soil depth on label)

1. When shaking is done, set centrifuge tubes next to funnels for 15 min to settle
2. Pour supernatant through funnel and allow to drain into plastic scintillation vials being careful not to collect soil in the filtrate.
3. Discard the first few drops, shake to rinse vial and collect the remainder
4. Once vial is about 1/3 full of liquid, cap and allow some air space at the top for expansion (when you freeze the sample)
5. Place vials in tray (label tray with name, sample source and date of soil collection)
6. **Steps 15-17 are for the gravimetric soil moisture content determination only. This is for *the samples which were weighed into the envelopes or aluminium tins only.***
7. Oven dry soil at 105 degrees C for 48 hours or until constant weight
8. When drying is complete, remove envelopes or tins from oven and allow to cool for 15 minutes.
9. Weigh all the tins or bags with dry soil and record the weights

**Calculations**

% soil moisture = ((wet soil wt) – (dry soil wt – envelope wt.) / (dry soil wt. – tin/envelope wt.)) \* 100

**LOCATIONS**

* Ntubwi
* Nsanama
* Nyambi

**TREATMENTS**

For soil sampling and soil extractions only focus on six treatments (1, 2, 4, 5, 7 and 8) in the Ntubwi, Nsanama and Nyambi EPAs. The six treatments and fertilization requirements are shown in Table 1.

**Table 1**. Residue management trials and fertilization treatments in two rotation cycles of experiment

|  |  |  |  |  |
| --- | --- | --- | --- | --- |
| **Trt** | **Years 1 and 3** | **Years 2 and 4** | **NPK**  **N** | **Urea N** |
| 1 | Maize + 69 kg/ha N | Maize + no residues | 0 | 0 |
| 2 | Maize + 69 kg/ha N | Maize + x2 residues (from plots 1 and 2) | 0 | 0 |
| 4 | Maize + 69 kg/ha N | Maize + no residues+ 35 kg/ha N | 23 | 12 |
| 5 | Maize + 69 kg/ha N | Maize + x2 residues (from plots 4 and 5) + 35 kg/ha N | 23 | 12 |
| 7 | Pigeonpea/Gnut + 35 kg/ha N | Maize + no residues + 35 kg/ha N | 23 | 12 |
| 8 | Pigeonpea/Gnut + 35 kg/ha N | Maize + x2 residues (from plots 7 and 8) + 35 kg/ha N | 23 | 12 |